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YELLOWSTONE RIVER COMPACT COMMISSION

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UNITED STATES

MONTANA



TWENTY-FIFTH ANNUAL REPORT

1976

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TWENTY-FIFTH ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1976

YELLOWSTONE RIVER COMPACT COMMISSION

421 Federal Building
Helena, Montana

Honorable Ed Herschler
Governor of the State of Wyoming
Cheyenne, Wyoming

Honorable Thomas L. Judge
Governor of the State of Montana
Helena, Montana

Honorable Arthur A. Link
Governor of the State of North Dakota
Bismarck, North Dakota

Sirs:

Pursuant to Article III of the Yellowstone River Compact, the Commission submits the following twenty-fifth annual report of activities for the period ending September 30, 1976.

The Commission held the annual meeting at Billings, Montana on November 9, 1976. Mr. George L. Christopoulos, Wyoming State Engineer, Mr. Orrin Ferris, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, the designated representatives of their respective states, and Mr. Walter R. Scott, the designated Federal representative and chairman, were all present.

Others present were:

Jack D. Palma, Assistant Attorney General,
State of Wyoming, Cheyenne, Wyoming,
Frank J. Trelease, Chief, Water Planning Program,
Wyoming State Engineers Office, Cheyenne, Wyoming,
Clem Lord, Wyoming State Engineers Office,
Cheyenne, Wyoming,
Paul Kawulok, Wyoming Board of Control,
Sheridan, Wyoming,
Ted J. Doney, Attorney, Montana Department of Natural
Resources and Conservation, Helena, Montana,
Murray G. Sagsveen, Assistant Attorney General,
State of North Dakota, Bismarck, North Dakota
Alvin E. Bielefeld, Field Solicitor, Department
of the Interior, Billings, Montana,
George M. Pike, U.S. Geological Survey, Helena,
Montana,
Katherine L. Cox, U.S. Geological Survey, Compact
Stenographer, Bismarck, North Dakota

There were no incidents during the year that required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission feels that a program of intensive water-use regulations is not necessary. However, the attention of the Commission is focused on the need to define the detailed procedures for implementing Compact provisions previous to the time when development of water within the Yellowstone River Basin requires that these provisions be enforced.

The interest in Yellowstone River water for coal development and peripheral needs has continued to increase and it is evident that, at some yet undetermined time, it will be necessary to divide the waters of the Yellowstone River System as allocated by Article V of the Compact.

The documentation of pre-1950 water rights has been completed in Wyoming. The new 1973 Water Use Act is assisting that state in its documentation, although it is still incomplete.

A problem that continues to be of major long-range concern to the Commission is the lack of proper quantification of all existing water rights. Of particular concern are the water rights of the Indian tribes and the implied federal reserved rights. The Commission believes that studies and action necessary to quantify these rights should be expedited.

Intake Water Company filed suit against the Commission and its members in Federal District Court in Billings, Montana, on June 29, 1973, which was discussed in the twenty-second annual report. Since then the Montana Department of Natural Resources and Conservation has brought suit in state court to invalidate any water right that the Intake Water Company purported to hold for Yellowstone River waters. This trial began on November 18, 1975, resulting in a ruling in favor of Intake Water Company. The state has appealed to the Montana Supreme Court. A decision is expected in late 1976. The Federal District Judge has stayed the Federal action until it is determined whether the Intake Water Company actually has a water right. If the Company does not have a water right, the suit against the Commission would be dismissed.

The Commission feels that due to the potential for large-scale use of water associated with coal development, joint allocation and development studies should be carried out in the near future. To this end special meetings, conducted as work sessions, will be scheduled to continue to document understandings and to develop procedures for implementation of Article V of the Compact.

The budgets for fiscal years 1976 through 1978 are discussed in the following general report. The amount of funds required for future Commission activities will depend largely on the outcome of water-development plans, inflation, and the degree of water administration required.

Respectfully submitted,

George L. Christopoulos

George L. Christopoulos
Commissioner for Wyoming

Orrin Ferris

Orrin Ferris
Commissioner for Montana

Walter R. Scott

Walter R. Scott
Federal Representative

GENERAL REPORT

Cost:

The work funded by the Commission, which to date has been primarily concerned with the collection of required hydrologic data, has been financed through cooperative arrangements whereby Montana and Wyoming each bear one-fourth of the cost and the remaining one-half is borne by the United States. The salaries and necessary expenses of the State and Federal representatives, and hydrologic data made available by other agencies, are not evaluated or considered as expenses of the Commission.

The expense of the Commission during Fiscal Year 1976 was \$19,700, in accordance with the budget adopted for the year.

The budgets for Fiscal years 1977 and 1978 were tentatively adopted subject to the availability of appropriations.

The budgets for the three fiscal years are summarized as follows:

July 1, 1976 to September 30, 1976 (Transition Quarter): 1/

Continuation of existing stream-gaging program \$ 4,900

October 1, 1976 to September 30, 1977 (Fiscal Year 1977):

Continuation of existing stream-gaging program 21,200

October 1, 1977 to September 30, 1978 (Fiscal Year 1978):

Estimate for continuation of existing stream-gaging program 23,120

Gaging Stations:

Gaging stations at the measuring sites specified in the Compact were continued in operation and satisfactory discharge records collected at each. In addition, a station on Prairie Dog Creek near the Montana-Wyoming State line was operated for Compact administration purposes. Locations of gaging and reservoir stations are shown on a map of the Yellowstone River basin at the end of the report.

1/ The Federal fiscal year changed to run from 10/1/76 to 9/30/77, and the 3-month period was necessary to accomplish the shift.

During the Water Year ending September 30, 1976, annual streamflow at the designated points of measurement in Montana was slightly above average except in the Powder River basin and Tongue River basin where the flow was 92 and 91 percent of average respectively.

Water stored in the mountain snowpack was above average at the higher elevations at the beginning of spring and a consequent high runoff occurred from the upper end of the basin.

Details of streamflow for Water Year 1976 and bar graphs showing comparisons with average flows during selected base periods and with the preceding year are given in Appendix B.

Diversions:

There were no incidents during the year that required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission feels that a program of intensive water-use regulations is not necessary.

Storage:

In reservoirs completed after January 1, 1950

Bighorn Lake, a U.S. Bureau of Reclamation project on the Bighorn River, and the largest storage project in the basin, contained 1,018,000 acre-feet at the beginning of the year and 1,019,000 acre-feet at the close. It fluctuated from a minimum of 742,000 acre-feet on May 20, 1976, to a maximum of 1,044,000 acre-feet on November 6, 1975. Boysen Reservoir, located on the Wind River and operated by the U.S. Bureau of Reclamation, began the year with 662,900 acre-feet in storage and ended with 678,100 acre-feet. Details regarding these reservoirs are given in Appendix C. The Commission is cognizant of other reservoirs in this general group and considers their aggregate effect to be insufficient to warrant the collection of storage data at this time.

In reservoirs existing on January 1, 1950

As a matter of record and general information, month-end storage data are given in Appendix D for reservoirs in existence above the points of measurement on January 1, 1950. These data are pertinent to allocation under Article V, Section C, Item 5 of the Compact.

RULES AND REGULATIONS FOR ADMINISTRATION OF
THE YELLOWSTONE RIVER COMPACT

A compact, known as the Yellowstone River Compact, between the States of Wyoming, Montana and North Dakota, having become effective on October 30, 1951 upon approval of the Congress of the United States, which apportions the waters of certain interstate tributaries of the Yellowstone River which are available after the appropriative rights existing in the States of Wyoming and Montana on January 1, 1950 are supplied, and after appropriative rights to the use of necessary supplemental water are also supplied as specified in the Compact, the following rules and regulations are adopted subject to the provisions for amendment, revision or abrogation as provided herein.

Article I. Collection of Water Records

- A. It shall be the joint and equal responsibility of the members of the states of Wyoming and Montana to collect, cause to be collected or otherwise furnish records of tributary stream flow at the points of measurement specified in Article V (B) of the Compact, or as near thereto as is physically or economically feasible or justified.

1. Clarks Fork

The gaging station known as Clarks Fork near Silesia, Montana and located in NE 1/4 SE 1/4 sec.1, T.4 S., R.23 E., shall be the point of measurement for the Clarks Fork.

2. Bighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River at Bighorn, Montana and located in NE 1/4 NE 1/4 sec.33, T.5 N., R.34 E., shall temporarily be the designated point of measurement on that stream. The flow of the Little Bighorn River as measured at the gaging station near Hardin, Montana, and located in NE 1/4 NE 1/4 sec.19, T.1 S., R.34 E., shall be considered the point of measurement for that stream, except that if or when satisfactory records are not available, the records for the nearest upstream station with practical corrections for intervening inflow or diversion shall be used.

3. Tongue River

The gaging station known as the Tongue River at Miles City, Montana and located in SE 1/4, sec.23, T.7 N., R.47 E., shall temporarily be the point of measurement for that stream.

4. Powder River

The gaging station known as the Powder River near Locate, Montana and located in SW 1/4 sec.14, T.8 N., R.51 E., shall temporarily be the designated point of measurement for that stream.

- B. Records of total annual diversion in acre-feet above the points of measurement designated in the Compact for irrigation, municipal and industrial uses developed after January 1, 1950, shall be furnished by the members of the Commission for their respective states, at such time as the Commission deems necessary for interstate administration as provided by the terms of the Compact. Providing that if it be acceptable to the Commission, reasonable estimates thereof may be substituted.
- C. Annual records of the net change in storage in all reservoirs, not excluded under Article V (E) of the Compact, above the point of measurement specified in the Compact and completed after January 1, 1950, and the annual net change in reservoirs existing prior to January 1, 1950, which is used for irrigation, municipal and industrial purposes developed after January 1, 1950, shall be the primary responsibility of the member of the Commission in whose state such works are located; providing such data is not furnished by federal agencies under the provisions of Article III (D) of the Compact, or collected by the Commission.

Article II. Office and Officers

- A. The office of the Commission shall be located, and be that of the United States Geological Survey, in Helena, Montana.
- B. The Chairman of the Commission shall be the federal representative as provided in the Compact.
- C. The Secretary of the Commission shall be as provided for in Article III of these rules.
- D. The credentials of each member of the Commission shall be placed on file in the office of the Commission.

Article III. Secretary

- A. The Commission, subject to the approval of the Director of the United States Geological Survey, shall enter into cooperative agreements with the U.S. Geological Survey for such engineering and clerical services as may reasonably be necessary for the administration of the Compact. Said agreements shall provide that the Geological Survey shall:
 - 1. Maintain and operate gaging stations at or near the points of measurement specified in Article V (A) of the Compact.
 - 2. Assemble factual information on stream flow, diversion and reservoir storage for the preparation of an annual report to the Governors of the signatory states.
 - 3. Make such investigations and reports as may be requested by the Commission in aid of its administration of the Compact.
- B. Act as Secretary to the Commission.

Article IV. Budget

- A. At the annual meeting of each even numbered year or prior thereto, the Commission shall adopt a budget for operation during the ensuing biennium beginning July first. Such budget shall set forth the total cost of construction, maintenance and operation of gaging stations, the cost of engineering and clerical aid, and other necessary expenses excepting the salaries and personal expenses of the Commissioners. On odd-numbered years revisions of the budget shall be considered.
- B. It shall be the obligation of the Commissioners of the states of Montana and Wyoming to endeavor to secure from the Legislature of their respective states sufficient funds with which to meet the obligations of this Compact, except insofar as provided by the federal government.

Article V. Meetings

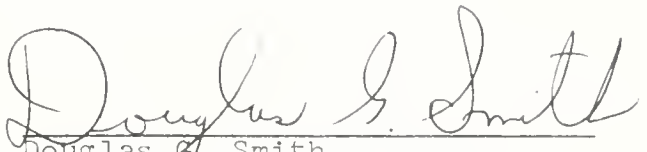
An annual meeting of the Commission shall be held each November at some mutually agreeable point in the Yellowstone River basin for consideration of the annual report for the water year ending the preceding September 30th, and for the transaction of such other business consistent with its authority; provided that by unanimous consent of the Commission the


date and place of the annual meeting may be changed. Other meetings as may be deemed necessary shall be held at a time and place set by mutual agreement, for the transaction of any business consistent with its authority.

No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

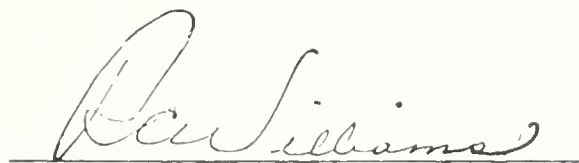
Article VI. Amendments, Revisions and Abrogations.

The Rules and Regulations of the Commission may be amended or revised by a unanimous vote at any meeting of the Commission.


Douglas S. Smith
Commissioner for Montana


Floyd A. Bishop
Commissioner for Wyoming

ATTESTED:


Robert C. Williams
Federal Representative

Adopted November 17, 1953
Amended November 9, 1970

Factors for converting English Units to International System
(SI) Units.

The following factors may be used to convert the English units published herein to the International System of Units (SI). Subsequent reports will contain both the English and SI unit equivalents in the station manuscript descriptions until such time that all data will be published in SI units.

<u>Multiply English units</u>	<u>By</u>	<u>To obtain SI units</u>
Length		
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
Area		
acres	4047	square meters (m ²)
	.4047	*hectares (ha)
	.4047	square hectometer (hm ²)
	.004047	square kilometers (km ²)
square miles (mi ²)	2.590	square kilometers (km ²)
Volume		
cubic feet (ft ³)	28.32	cubic decimeters (dm ³)
	.02832	cubic meters (m ³)
cfs-day (ft ³ /s-day)	2447	cubic meters (m ³)
	.002447	cubic hectometers (hm ³)
acre-feet (acre-ft)	1233	cubic meters (m ³)
	.001233	cubic hectometers (hm ³)
	.000001233	cubic kilometers (km ³)
Flow		
cubic feet per second (ft ³ /s)	28.32	liters per second (l/s)
	28.32	cubic decimeters per second (dm ³ /s)
	.02832	cubic meters per second (m ³ /s)

*The unit hectare is approved for use with the International System (SI) for a limited time. See NBS Special Bulletin 330, p. 15, 1972 edition.

MONTHLY SUMMARY OF DISCHARGE

06208800 CLARKS FORK YELLOWSTONE RIVER NEAR SILESIA, MT

LOCATION.--Lat 45°30'48", long 108°49'41", in NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.1, T.4 S., R.23 E., Carbon County, on left bank 0.5 mi (0.8 km) downstream from Whitehorse Canal intake, 1 mi (1.6 km) upstream from Rock Creek, 3 mi (4.8 km) south of Silesia, and at mile 19 (30.6 km).

DRAINAGE AREA.--2,093 mi² (5,421 km²).

PERIOD OF RECORD.--October 1969 to September 1976. Records for July 1921 to September 1969 (published as Clarks Fork Yellowstone River at Edgar) at site 5 mi (8.0 km) upstream not equivalent owing to diversion in Whitehorse Canal during irrigation season. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 3,410 ft (1,039 m), from topographic map.

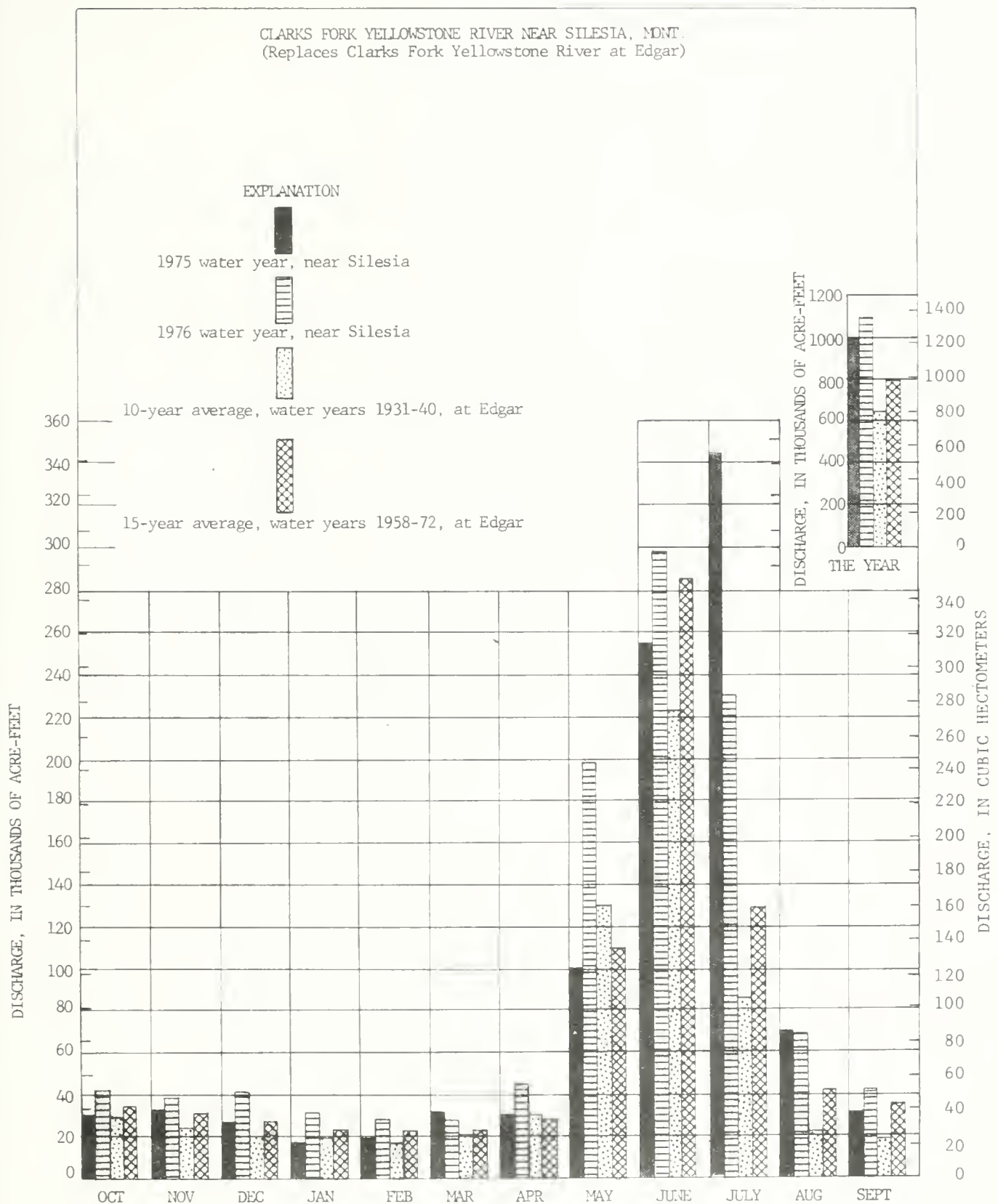
REMARKS.--Records good except those for winter period, which are poor. Diversion for irrigation of about 42,600 acres (172 km²) of which 1,100 acres (4.45 km²) lies below station. In addition, about 9,000 acres (36.4 km²) of land above station are irrigated by diversions from the adjoining Rock Creek basin.

AVERAGE DISCHARGE.--7 years (1970-76), 1,307 ft³/s (36.1 m³/s), 922,300 acre-ft/yr (1.14 km³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,800 ft³/s (334 m³/s) June 10, 1972, gage height, 7.51 ft (2.289 m); maximum gage height, 7.82 ft (2.384 m) July 6, 1975; minimum daily discharge, 140 ft³/s (3.96 m³/s) Dec. 4, 1972.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,750 ft³/s (219 m³/s) June 10; gage height, 6.27 ft (1.911 m); minimum daily, 230 ft³/s (6.51 m³/s) Mar. 4.

Month	Second foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1975	21,193	684	934	479	42,040
November	19,616	654	833	350	38,910
December	21,067	680	1,090	460	41,790
January 1976	15,760	508	700	400	31,260
February	14,474	499	630	250	28,710
March	13,862	447	690	230	27,500
April	22,842	761	1,130	427	45,310
May	99,999	3,226	5,320	916	198,300
June	150,650	5,022	7,270	2,990	298,800
July	116,310	3,752	6,400	1,680	230,700
August	34,624	1,117	2,610	489	68,680
September 1976	21,440	715	1,110	435	42,530
1976 water year	551,837	1,508	7,270	230	1,095,000



Comparison of discharge during 1976 water year with 1975 water year near Silesia and with average discharge for water years 1931-40 and 1958-72 at Edgar.

MONTHLY SUMMARY OF DISCHARGE

06294000 LITTLE BIGHORN RIVER NEAR HARDIN, MT

LOCATION (revised).--Lat 45°44'10", long 107°33'24", in NW¼SW¼NW¼ sec.20, T.1 S., R.34 E., Big Horn County, on right bank 15 ft (4.6 km) downstream from bridge on Sarpy Road, 0.2 mi (0.3 km) upstream from terminal wasteway of Agency Canal, 0.6 mi (1.0 km) upstream from mouth, and 2.3 mi (3.7 km) east of Hardin.

DRAINAGE AREA.--1,294 mi² (3,351 km²).

PERIOD OF RECORD.--June 1953 to September 1976. Records since June 1953 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,890 ft (881 m), from topographic map. Prior to Oct. 7, 1953, nonrecording gage at site 0.4 mi (0.6 km) downstream. Oct. 7, 1953, to May 6, 1963, water-stage recorder at site 0.3 mi (0.5 km) downstream. May 6, 1963, to Nov. 6, 1963, nonrecording gage at site 0.4 mi (0.6 km) downstream. All at different datums. Nov. 7, 1963, to Aug. 15, 1976, water-stage recorder at site 35 ft (10.7 m) downstream at present datum.

REMARKS.--Records good except those for winter period and July to September, which are poor. Flow partly regulated by Willow Creek Reservoir (capacity, 23,000 acre-ft, 28.4 hm³). Diversions for irrigation of about 17,000 acres (68.8 km²) above station. Figures of discharge given herein include flow of terminal wasteway of Agency Canal.

AVERAGE DISCHARGE.--23 years, 313 ft³/s (8.86 m³/s), 226,800 acre-ft/yr (280 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,520 ft³/s (128 m³/s) Apr. 2, 1965; maximum gage height, 11.78 ft (3.591 m) Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.20 ft³/s (0.006 m³/s) Aug. 7, 1961, result of discharge measurement.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,380 ft³/s (39.1 m³/s) June 24, gage height, 4.00 ft (1.219 m); maximum gage height, 4.24 ft (1.292 m) Dec. 5 (backwater from ice); minimum daily discharge, 61 ft³/s (1.73 m³/s) Nov. 30.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1975	8,225	265	334	212	16,310
November	5,523	184	266	61	10,950
December	6,515	210	260	90	12,920
January 1976	8,730	282	350	170	17,320
February	12,400	428	600	200	24,600
March	10,518	339	658	180	20,860
April	8,680	289	508	229	17,220
May	15,971	515	841	281	31,680
June	29,476	983	1,350	776	58,470
July	11,336	366	837	92	22,840
August	4,140	134	262	94	8,210
September 1976	4,981	166	234	98	9,880
1976 water year	126,495	346	1,350	61	250,900

MONTHLY SUMMARY OF DISCHARGE

06294700 BIGHORN RIVER AT BIGHORN, MT

LOCATION.--Lat 46°08'50", long 107°28'00", in NE¼NE¼ sec.33, T.5 N., R.34 E., Treasure County, on right bank just downstream from bridge on old U.S. Highway 10, 0.3 mi (0.5 km) downstream from bridge on Interstate Highway 94, 0.7 mi (1.1 km) upstream from mouth, 1.3 mi (2.1 km) southwest of Bighorn, and 4.4 mi (7.1 km) east of Custer.

DRAINAGE AREA.--22,885 mi² (59,272 km²). Area at site used prior to Oct. 7, 1955, 22,410 mi² (58,042 km²).

PERIOD OF RECORD.--May 1945 to September 1976. Published as "near Custer", 1945-55. Records since January 1950 available in annual reports of the Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,690 ft (820 m), by barometer. May 11 to Dec. 6, 1945, nonrecording gage, and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 mi (6.4 km) upstream at different datum.

REMARKS.--Records good except those for period of backwater from Yellowstone River (Apr. 9 to Aug. 16), which are fair. Flow regulated by Bighorn Lake beginning November 1965 (usable capacity, 1,356,000 acre-ft, 1.67 km³). Major regulation prior to November 1965 by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft, 1.73 km³ (see appendixes C and D). Diversions for irrigation of about 465,000 acres (1,880 km²) above station.

AVERAGE DISCHARGE.--31 years, 3,966 ft³/s (112.3 m³/s), 2,874,000 acre-ft/yr (3.54 km³/yr), unadjusted.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26,200 ft³/s (742 m³/s) June 24, 1947, gage height, 8.79 ft (2.679 m), site and datum then in use, from rating curve extended above 12,500 ft³/s (354 m³/s); maximum gage height recorded, 14.21 ft (4.331 m) Apr. 2, 1965 (ice jam); minimum discharge, about 275 ft³/s (7.79 m³/s) Nov. 15, 1959, result of freezeup; minimum daily, 400 ft³/s (11.3 m³/s) Apr. 4, 1967

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,840 ft³/s (222 m³/s) June 23; maximum gage height, 6.28 ft (1.914 m) June 11 (backwater from Yellowstone River); minimum daily discharge, 1,350 ft³/s (38.2 m³/s) Nov. 1.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet	Adjusted runoff, in acre-feet*
Oct. 1975	102,520	3,307	3,560	3,130	203,300	229,300
Nov.	133,060	4,435	5,080	1,350	263,900	186,800
Dec.	141,890	4,577	5,620	3,260	281,400	229,300
Jan. 1976	137,180	4,425	5,060	3,500	272,100	225,700
Feb.	132,560	4,571	5,120	3,700	262,900	230,400
Mar.	156,020	5,033	5,690	4,400	309,500	258,000
Apr.	154,350	5,145	5,800	1,560	306,200	293,200
May	173,960	5,612	6,200	5,010	345,000	337,600
June	195,420	6,514	7,370	5,690	387,600	555,700
July	110,320	3,559	6,030	2,260	218,800	237,500
Aug.	75,470	2,435	2,700	2,170	149,700	182,500
Sept. 1976	77,870	2,596	2,890	2,260	154,500	188,100
1976 water year	1,590,620	4,346	7,370	1,350	3,155,000	3,156,000

* Adjusted for change in contents in Bighorn Lake.

BIGHORN RIVER AT BIGHORN, MONT.
 (Adjusted for change in contents in Bighorn Lake
 minus
 Little Bighorn River near Hardin, Mont.)

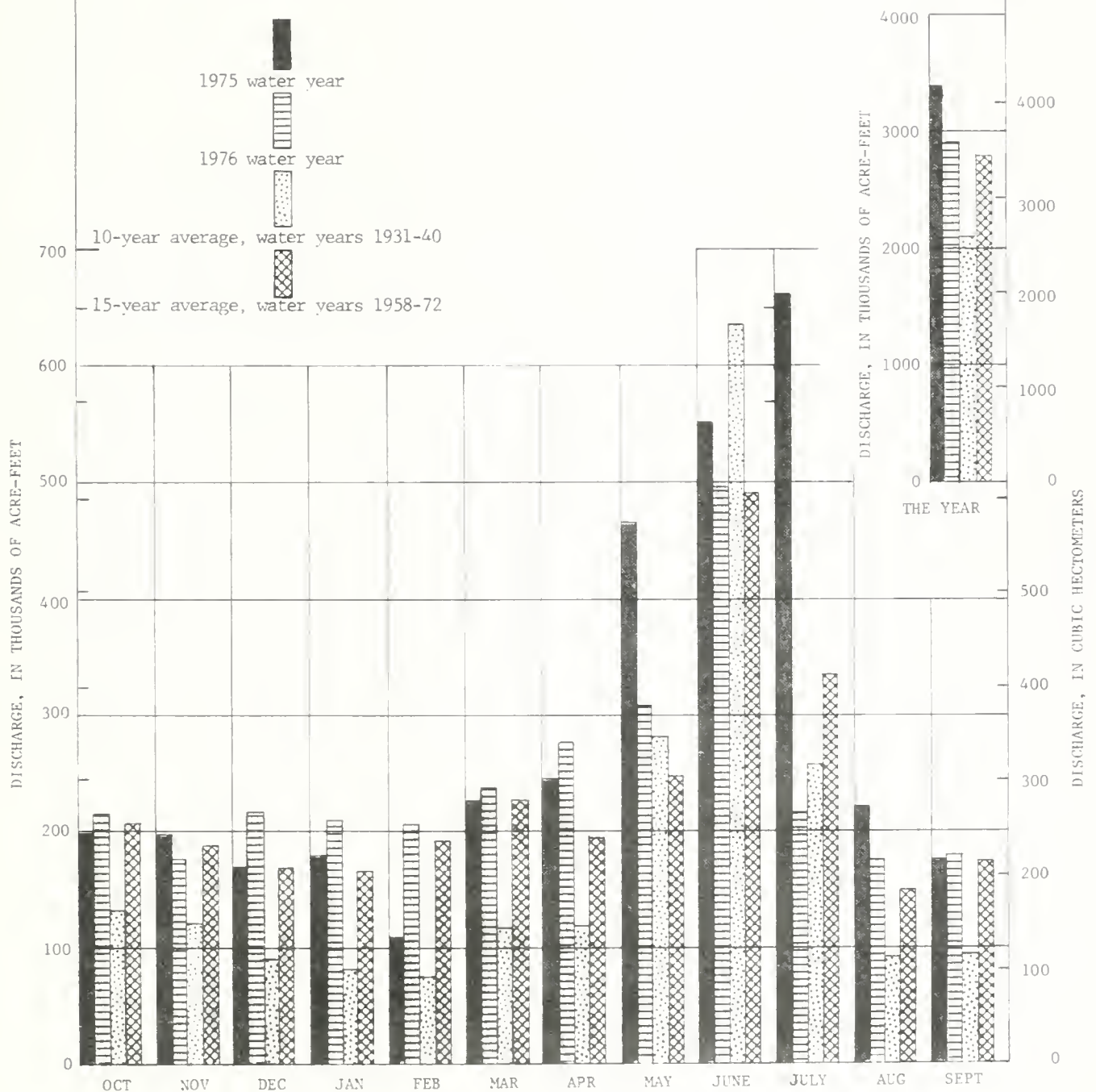
EXPLANATION

1975 water year

1976 water year

10-year average, water years 1931-40

15-year average, water years 1958-72



Comparison of discharge during 1976 water year with 1975 water year and with average discharge for water years 1931-40 and 1958-72.

MONTHLY SUMMARY OF DISCHARGE

06306250 PRAIRIE DOG CREEK NEAR ACME, WY

LOCATION.--Lat 44°59'02", long 106°50'21", in NE¼SW¼SW¼ sec.23, T.58 N., R.83 W., Sheridan County, on right bank 600 ft (183 m) upstream from county bridge, 0.9 mi (1.5 km) upstream from mouth, 2.8 mi (4.5 km) downstream from Coutant Creek, and 7.6 mi (12.2 km) northeast of Acme.

DRAINAGE AREA.--358 mi² (927 km²).

PERIOD OF RECORD.--October 1970 to September 1976. Records for May 1965 to September 1970 in files of Office of Wyoming State Engineer. Records since October 1970 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 3,450 ft (1,052 m), from topographic map.

REMARKS.--Records fair except those for winter period and August, which are poor. Diversions above station for irrigation of about 13,600 acres (55.0 km²) of which about 60 acres (243,000 m²) lies below station. Flow supplemented by 3 transbasin diversions from North Piney Creek and South Piney Creek via Prairie Dog ditch, Piney and Cruse ditch and Mead-Coffeen ditch.

AVERAGE DISCHARGE.--6 years, 43.8 ft³/s (1.24 m³/s), 31,730 acre-ft/yr (39.1 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 738 ft³/s (20.9 m³/s) Mar. 5, 1975, gage height, 6.01 ft (1.832 m), from rating curve extended above 190 ft³/s (5.38 m³/s) on basis of step-backwater computation; minimum daily, 6.3 ft³/s (0.18 m³/s) June 4, 5, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 146 ft³/s (4.13 m³/s) Feb. 16, gage height, 3.00 ft (0.914 m); minimum daily, 6.3 ft³/s (0.18 m³/s) June 4, 5.

<u>Month</u>	<u>Second-foot days</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Runoff, in acre-feet</u>
October 1975	691	22.3	34	14	1,370
November	740	24.7	30	19	1,470
December	1,002	32.3	59	16	1,990
January 1976	774	25.0	35	16	1,540
February	1,742	60.1	116	28	3,460
March	1,466	47.3	66	30	2,910
April	1,310	43.7	89	34	2,600
May	1,337	43.1	87	15	2,650
June	1,097.5	36.6	83	6.3	2,180
July	554.4	17.9	47	9.4	1,100
August	766	24.7	30	17	1,520
September 1976	1,320	44.0	64	22	2,620
1976 water year	12,799.9	35.0	116	6.3	25,390

MONTHLY SUMMARY OF DISCHARGE

06308500 TONGUE RIVER AT MILES CITY, MT

LOCATION.--Lat 46°21'30", long 105°48'24" in SE¼ sec.23, T.7 N., R.47 E., Custer County, on right bank 4 mi (6.4 km) south of Miles City and 8 mi (12.9 km) upstream from mouth.

DRAINAGE AREA.--5,379 mi² (13,923 km²).

PERIOD OF RECORD.--April 1938 to April 1942, April 1946 to September 1976. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to October 1932. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950 available in annual report of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,370 ft (722 m), by barometer. April 1938 to April 1942, nonrecording gage at site 8 mi (12.9 km) upstream at different datum. April 1946 to Sept. 30, 1963, at datum 1.00 ft (0.30 m) higher.

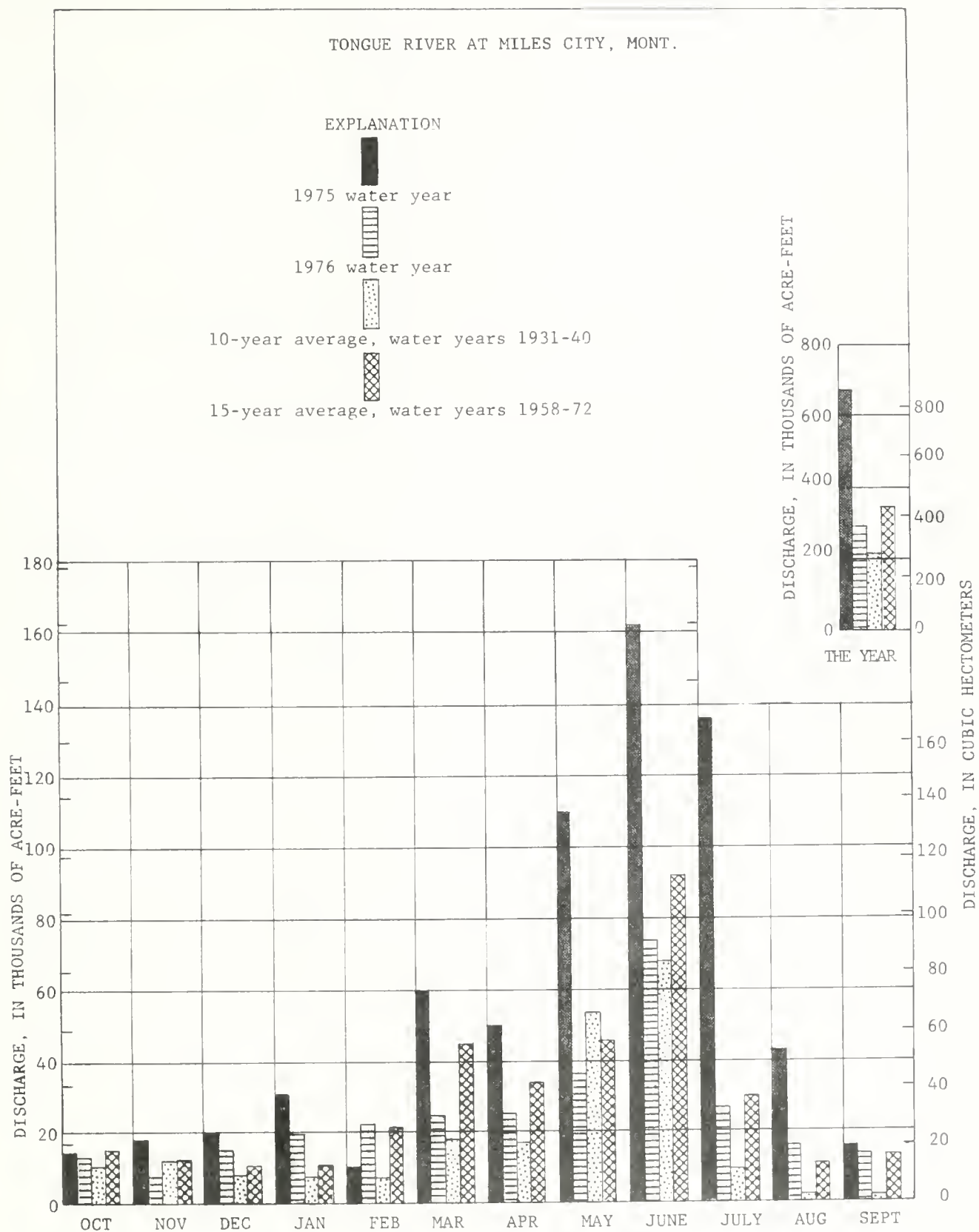
REMARKS.--Records good except those for October to March, which are poor. Flow regulated by Tongue River Reservoir (appendix D) and many small reservoirs in Wyoming (combined capacity, about 15,000 acre-ft, 18.5 hm³). Diversions for irrigation of about 90,000 acres (364 km²) above station.

AVERAGE DISCHARGE.--33 years (1938-41, 1946-76), 441 ft³/s (12.5 m³/s), 319,500 acre-ft/yr (394 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,300 ft³/s (377 m³/s) June 15, 1962, gage height, 12.33 ft (3.758 m), present datum, from rating curve extended above 5,200 ft³/s (147 m³/s) on basis of float measurement; maximum gage height, 13.27 ft (4.045 m), present datum, Mar. 19, 1960, Feb. 15, 1971 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,880 ft³/s (53.2 m³/s) June 15, gage height, 4.50 ft (1.372 m); maximum gage height, 4.55 ft (1.387 m) Feb. 13 (backwater from ice); minimum daily discharge, 80 ft³/s (2.27 m³/s) Feb. 10.

<u>Month</u>	<u>Second-foot days</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Runoff, in acre-feet</u>
October 1975	6,519	210	257	175	12,930
November	3,666	122	218	35	7,270
December	7,585	245	360	45	15,040
January 1976	9,705	313	350	265	19,250
February	11,275	389	530	280	22,360
March	12,318	397	540	290	24,430
April	12,559	419	665	348	24,910
May	18,033	582	1,010	448	35,770
June	37,209	1,240	1,780	578	73,800
July	13,502	436	1,070	152	26,780
August	7,848	253	320	156	15,570
September 1976	6,801	227	308	152	13,490
1976 water year	147,020	402	1,780	35	291,600



Comparison of discharge during 1976 water year with 1975 water year and with average discharge for water years 1931-40 and 1958-72.

MONTHLY SUMMARY OF DISCHARGE

06326500 POWDER RIVER NEAR LOCATE, MT

LOCATION.--Lat 46°26'56", long 105°18'44", in NW¼SW¼ sec.14, T.8 N., R.51 E., Custer County, on left bank 1.5 mi (2.4 km) downstream from bridge on U.S. Highway 12 at present site of Locate (5 mi, 8.0 km, west of former site of Locate), 1.5 mi (2.4 km) upstream from Locate Creek, and 25 mi (40 km) east of Miles City.

DRAINAGE AREA.--13,194 mi² (34,172 km²). Area at site used prior to Oct. 1, 1965, 13,189 mi² (34,160 km²).

PERIOD OF RECORD.--March 1938 to September 1976. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,390 ft (728 m), by barometer. Prior to July 11, 1947, nonrecording gage at bridge 1.5 mi (2.4 km) upstream and July 11, 1947, to Sept. 30, 1965, water-stage recorder at site near bridge at different datum. Oct. 1, 1965, to Oct. 4, 1966, nonrecording gage, and Oct. 5, 1966, to Apr. 15, 1969, water-stage recorder at site 200 ft (61 m) upstream at present datum.

REMARKS.--Records good except those for winter period, which are poor. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft (45.4 hm³). Diversions for irrigation of about 52,000 acres (210 km²).

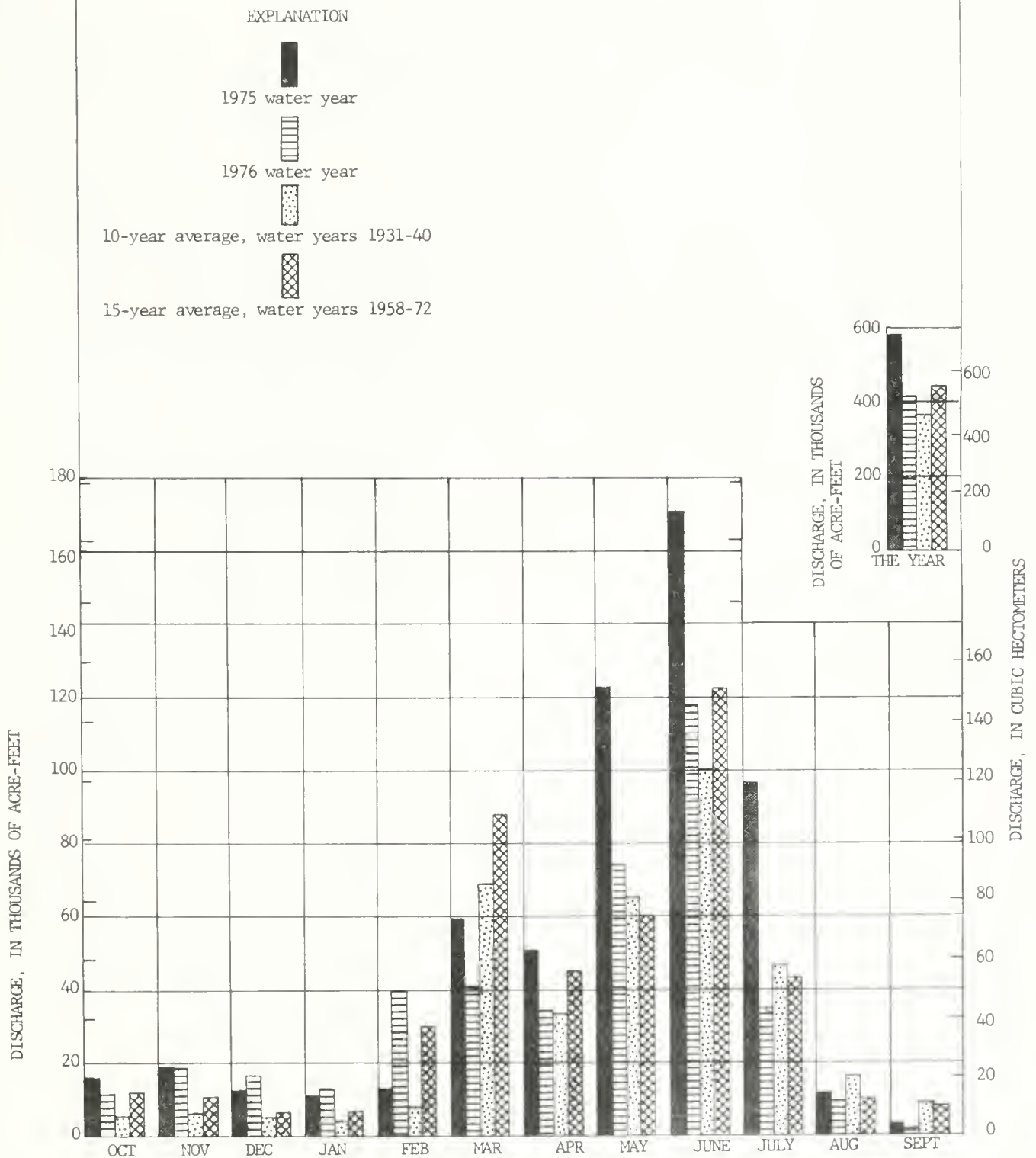
AVERAGE DISCHARGE.--38 years, 620 ft³/s (17.6 m³/s), 449,200 acre-ft/yr (554 hm³/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge observed, 31,000 ft³/s (878 m³/s) Feb. 19, 1943, gage height, 11.23 ft (3.423 m), site and datum then in use, from rating curve extended above 17,000 ft³/s (481 m³/s); no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge observed, 3,480 ft³/s (98.6 m³/s) June 15, gage height, 4.91 ft (1.497 m); maximum gage height, 6.25 ft (1.905 m) Feb. 25 (backwater from ice); minimum daily discharge, 20 ft³/s (0.57 m³/s) Sept. 10.

<u>Month</u>	<u>Second-foot days</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Runoff, in acre-feet</u>
October 1975	5,811	187	376	51	11,530
November	9,509	317	436	140	18,860
December	8,460	273	350	150	16,780
January 1976	6,675	215	310	110	13,240
February	20,140	694	1,400	320	39,950
March	20,621	665	1,420	300	40,900
April	17,500	583	902	436	34,710
May	37,501	1,210	1,950	606	74,380
June	59,420	1,981	3,280	1,260	117,900
July	17,583	567	1,340	87	34,880
August	4,880	157	606	32	9,680
September 1976	861	28.7	54	20	1,710
1976 water year	208,961	571	3,280	20	414,500

POWDER RIVER NEAR LOCATE, MONT.



Comparison of discharge for 1976 water year with 1975 water year and with average discharge for water years 1931-40 and 1958-72.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

06258900 BOYSEN RESERVOIR, WY

LOCATION.--Lat 43°25'00", long 108°10'37", in NW¼NW¼ sec.16, T.5 N., R.6 E., Fremont County, at dam on Wind River, 13 mi (21 km) north of Shoshoni, Wyoming.

DRAINAGE AREA.--7,700 mi² (19,943 km²).

PERIOD OF RECORD.--October 1951 to September 1976 (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is mean sea level, datum of 1933 (levels by Bureau of Reclamation).

REMARKS.--Reservoir is formed by rock-fill dam completed in October 1951. Storage began Oct. 11, 1951. Usable capacity, 742,100 acre-ft (915 hm³) between elevation 4,657.00 ft (1,419.454 m), invert of penstock pipe, and 4,725.00 ft (1,440.180 m), top of spillway gate. Dead storage, 59,880 acre-ft (73.8 hm³) below elevation 4,657.00 ft (1,419.454 m). Prior to Jan. 1, 1966, usable capacity was 757,800 acre-ft (934 hm³) and dead storage was 62,000 acre-ft (76.4 hm³), at same elevations. Crest of dam is at elevation 4,758 ft (1,450 m). Figures given herein represent usable contents. Water used for irrigation, flood control, and power development.

COOPERATION.--Records furnished by Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 862,500 acre-ft (1,060 hm³) July 6, 7, 1967 (elevation, 4,730.83 ft or 1,441.957 m); minimum daily (since normal use of water started), 189,800 acre-ft (234 hm³) Mar. 18, 19, 1956 (elevation, 4,684.18 ft or 1,427.738 m), capacity table then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 680,000 acre-ft (838 hm³) Aug. 26 (elevation, 4,721.73 ft or 1,439.183 m); minimum daily, 321,000 acre-ft (396 hm³) May 14 (elevation, 4,697.70 ft or 1,431.859 m).

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1975	4,720.80	662,900	-
October 31	4,720.00	648,500	-14,400
November 30.	4,719.01	630,800	-17,700
December 31.	4,716.42	586,300	-44,500
January 31, 1976	4,711.75	511,300	-75,000
February 29.	4,707.70	451,200	-60,100
March 31	4,705.34	418,100	-33,100
April 30	4,700.00	348,500	-69,600
May 31.	4,702.85	384,700	+36,200
June 30.	4,713.98	546,200	+161,500
July 31.	4,718.87	628,400	+82,200
August 31.	4,721.64	678,300	+49,900
September 30, 1976	4,721.63	678,100	-200
1976 water year			+15,200

* Does not include dead storage of 59,880 acre-feet (73.8 hm³).

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

06260300 ANCHOR RESERVOIR, WY

LOCATION.--Lat 43°39'50", long 108°49'27", in sec.26, T.43 N., R.100 W., Hot Springs County, at dam on South Fork Owl Creek, 2 mi (3.2 km) downstream from Middle Fork, 3 mi (4.8 km) southeast of Anchor, and 32 mi (51 km) west of Thermopolis.

DRAINAGE AREA.--125 mi² (324 km²), approximately.

PERIOD OF RECORD.--November 1960 to September 1976 (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is at mean sea level (Bureau of Reclamation datum).

REMARKS.--Reservoir is formed by concrete arch dam completed in 1960. Usable capacity, 17,170 acre-ft (21.2 hm³) between elevation 6,343.75 ft (1,933.575 m), invert of river outlet, and 6,441.00 ft (1,963.217 m), spillway crest, not including 68 acre-ft (83,800 m³) below elevation 6,343.75 ft (1,933.575 m). Prior to Oct. 1, 1971, usable capacity was 17,280 acre-ft (21.3 hm³) not including 149 acre-ft (184,000 m³) below the invert. Figures given herein represent usable contents. Water is used for irrigation of lands in Owl Creek basin.

COOPERATION.--Records furnished by Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 9,250 acre-ft (11.4 hm³) July 4, 1967 (elevation, 6,418.52 ft or 1,956.365 m); no storage on many days each year.

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 1,520 acre-ft (1.87 hm³) July 7 (elevation, 6,377.84 ft or 1,943.966 m); no storage on many days.

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1975	-	0	-
October 31	-	0	-
November 30.	-	0	-
December 31.	-	0	-
January 31, 1976	-	0	-
February 29.	-	0	-
March 31	-	0	-
April 30	6,354.68	189	+189
May 31	6,370.83	944	+755
June 30.	6,370.23	902	-42
July 31.	-	0	-902
August 31.	-	0	-
September 30, 1976	-	0	-

1976 water year 0

* Does not include dead storage of 68 acre-feet (83,800 m³).

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

06286400 BIGHORN LAKE NEAR ST. XAVIER, MT

LOCATION.--Lat 45°18'27", long 107°57'26", in SW¼SE¼ sec.18, T.6 S., R.31 E., Big Horn County, in block 13 of Yellowtail Dam on Bighorn River, 1.3 mi (2.1 km) upstream from Grapevine Creek, 15.5 mi (24.9 km) southeast of St. Xavier, and at mile 81.0 (130.3 km).

DRAINAGE AREA.--19,626 mi² (50,831 km²).

PERIOD OF RECORD.--November 1965 to September 1976 (monthend contents only). Prior to October 1969, published as "Yellowtail Reservoir."

GAGE.--Water-stage recorder in powerhouse control room. Datum of gage is mean sea level (levels by Bureau of Reclamation).

REMARKS.--Reservoir is formed by thin concrete-arch dam; construction began in 1961; completed in 1967. Storage began Nov. 3, 1965. Usable capacity, 1,356,000 acre-ft (1.67 km³) between elevation 3,296.50 ft (1,004.773 m), river outlet invert, and 3,657.00 ft (1,114.654 m), top of flood control. Elevation of spillway crest, 3,593.00 ft (1,095.146 m). Normal maximum operating level, 1,097,000 acre-ft (1.35 km³), elevation, 3,640.00 ft (1,109.472 m). Minimum operating level, 483,400 acre-ft (596 hm³), elevation, 3,547.00 ft (1,081.126 m). Dead storage, 18,970 acre-ft (23.4 hm³) below elevation 3,296.50 ft (1,004.773 m). Figures given herein represent usable contents. Water is used for power production, flood control, irrigation, and recreation.

COOPERATION.--Elevations and capacity table furnished by Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 1,346,000 acre-ft (1.66 km³) July 6, 1967 (elevation, 3,656.43 ft or 1,114.480 m); minimum since first filling, 660,700 acre-ft (815 hm³) Mar. 11, 1970 (elevation, 3,584.45 ft or 1,092.540 m).

EXTREMES FOR CURRENT YEAR.--Maximum contents, 1,044,000 acre-ft (1.29 km³) Oct. 31, Nov. 1, 5, 6; maximum elevation, 3,635.61 ft (1,108.134 m) Nov. 6; minimum contents, 742,000 acre-ft (915 hm³) May 20 (elevation, 3,598.35 ft or 1,096.777 m).

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1975.	3,633.19	1,018,000	--
October 31.	3,635.59	1,044,000	+26,000
November 30	3,628.15	966,900	-77,100
December 31	3,622.29	914,800	-52,100
January 31, 1976.	3,616.35	868,400	-46,400
February 29	3,612.57	835,900	-32,500
March 31.	3,604.82	784,400	-51,500
April 30.	3,602.89	771,400	-13,000
May 31.	3,601.77	764,000	-7,400
June 30	3,624.51	933,900	+169,900
July 31	3,626.61	952,600	+18,700
August 31	3,630.07	985,400	+32,800
September 30, 1976.	3,633.28	1,019,000	+33,600

1976 water year +1,000

* Does not include dead storage of 18,970 acre-feet (23.4 hm³).

RESERVOIRS IN EXISTENCE ON JANUARY 1, 1950

The extent, if any, of the use of reservoirs in this category which may be subject to Compact allocations was not determined. As a matter of hydrologic interest the monthend contents in acre-feet of four reservoirs are given. The first three reservoirs are in the Bighorn River basin, Wyoming and data on contents were furnished by the U.S. Bureau of Reclamation. Tongue River Reservoir in Montana is operated under the supervision of the Water Resources Division of the Montana Department of Natural Resources and Conservation, which agency furnished operating data.

Month	Contents, in acre-feet			
	06224500 <u>a/ Bull Lake</u>	<u>b/ Pilot Butte Reservoir</u>	06281500 <u>c/ Buffalo Bill Reservoir</u>	06307000 <u>d/ Tongue River Reservoir</u>
September 30, 1975.	69,600	20,540	307,400	13,100
October 31.	70,000	20,380	281,800	19,540
November 30	69,600	20,080	291,000	34,000
December 31	69,480	20,000	274,900	35,200
January 31, 1976.	68,760	19,930	267,500	34,800
February 29	67,690	19,780	246,500	36,800
March 31.	67,100	19,550	224,000	49,040
April 30.	67,570	23,020	173,000	36,600
May 31.	94,100	24,620	248,300	55,500
June 30	131,500	21,900	350,900	59,790
July 31	141,400	10,400	429,200	50,120
August 31	103,700	9,120	367,400	30,900
September 30, 1976.	55,760	8,880	318,800	25,540
Change in contents during water year	-13,840	-11,660	+11,400	+12,440

a/ Usable contents, from revised capacity table effective Oct. 1, 1965. Dead storage is 722 acre-feet (890,000 m³).

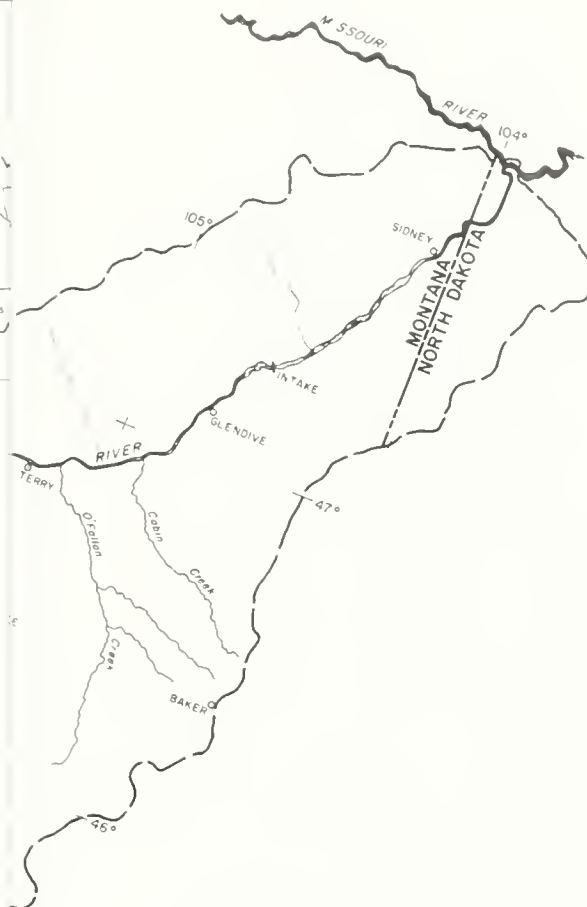
b/ Usable contents. Dead storage is 5,360 acre-ft (6.61 hm³).

c/ Usable contents, from revised capacity table based on survey of 1959. Contents prior to October 1960 based on survey of 1941. Dead storage is negligible.

d/ Usable contents. Dead storage is 1,400 acre-ft (1.73 hm³). Contents based upon sedimentation surveys of October 1948.



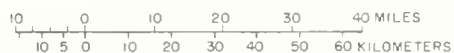
LOCATION MAP



YELLOWSTONE RIVER COMPACT COMMISSION YELLOWSTONE RIVER BASIN

EXPLANATION

- ▲ COMPACT STREAM GAGING STATIONS
- RESERVOIR CONTENT STATIONS





LOCATION MAP



YELLOWSTONE RIVER COMPACT COMMISSION
YELLOWSTONE RIVER BASIN

EXPLANATION

- ▲ COMPACT STREAM GAGING STATIONS
- RESERVOIR CONTENT STATIONS

